AU/ACSC/155/1999-04

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

OPERATIONAL RISK MANAGEMENT PROBLEMS IN AIR COMBAT COMMAND UNITS

MISGUIDED RISK QUANTIFICATION AND A LACK OF INTEGRATION COULD IMPEDE IMPLEMENTATION

by

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A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

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Maxwell Air Force Base, Alabama

April 1999

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Preface

I hate to see a person doing extra work or work that has little meaning or use. I chose to discuss Operational Risk Management (ORM) because while I was the chief of flight safety at Cannon AFB, I saw people developing ORM programs that where a waste of time. I was one of the first people to attend the Air Combat Command's (ACC) ORM training at Langley AFB and I was impressed with the proactive potential of ORM. At the same time, I was skeptical that ORM would become a misunderstood program rather than a way of thinking. During this training, the commander of ACC emphasized that ORM would be a philosophy change and not a new program. I chose this topic because I believe people are creating ORM programs without the proper understanding of the limitations of these ORM programs and they are not being integrated. I think some of these programs are forcing people to do more work for little gain.

I appreciate the help that I received on this project. There are a number of people that I talked to on the phone to gather information and generally discussed ORM issues at various ACC bases. Their assistance and insight was invaluable in helping me develop my own thoughts on what was happening throughout ACC with respect to ORM, and to ascertain the problems. Printed information on risk management in the Air University library was basically non-existent. Most of the published information had to be obtained through the inter-library loan department, so a special thanks goes out to Edith Williams for her help in getting these publications. Finally, I'd like to thank my research advisor for his help and multiple suggestions during the course of this paper. With his help, I was able to focus my thoughts and make the paper easier to read.

Abstract

In 1987, the US Army implemented Operational Risk Management (ORM) techniques in an attempt to reduce mishaps. By the early 1990s, the Army reduced serious mishaps by more than 80 percent. In 1996, Air Combat Command (ACC) outlined its ORM implementation strategy in an attempt to reduce all types of mishaps while improving operational effectiveness. While this plan allows for a tailored approach to a wing's unique culture, the implementation has created some problems within ACC units. The commander of ACC emphasized that this implementation is a top down change in philosophy and not necessarily a new safety program. This is important because a cultural change is required to embed ORM seamlessly into everyday missions. The main problem found during this study was that units are attempting to quantify risks without the necessary information or knowledge of the limitations with risk quantification. In addition to this misguided quantification, units are not properly integrating ORM into the mission; thus creating extra work that has little benefit. ACC is taking steps to improve the ORM process at the unit level by providing better information databases and automated risk assessments during mission scheduling. However, these programs are not in place and because of the emphasis ORM has from the top leadership, ACC units are basically trying to do too much too soon. This could seriously impede the ORM implementation plan due to frustration from a lack of progress with regards to minimizing risks and improving mission benefits. This study recommends several possible solutions to these problems, but emphasizes that more study is needed to find the best possible solutions to the ORM problems in ACC units.

Chapter 1

Introduction

> *Operational risk management is a logic-based, common sense approach to making calculated decisions on human, material, and environmental factors before, during, and after Air Force mission activities and operations.*
>
> —Air Force Instruction 91-213
> Operational Risk Management (ORM) Program

The goal of Operational Risk Management (ORM) is to enhance mission effectiveness at all levels, while preserving assets and safeguarding health and welfare.[1] There are four basic ORM principles: (1) accept no unnecessary risk, (2) make risk decisions at the appropriate level, (3) accept risks when benefits outweigh the costs, and (4) integrate ORM into Air Force doctrine and planning at all levels.[2] To accomplish this goal using these principles, the Air Combat Command (ACC) Commander (COMACC) has challenged everyone in ACC to use the six step process outlined in AFI 91-213 and AFI 91-215 to enhance mission effectiveness. The six steps are: (1) Identify Hazards, (2) Assess the Risk, (3) Analyze Risk Controls Measures, (4) Make Control Decisions, (5) Implement Risk Controls, and (6) Supervise and Review the process. Since 1997, squadrons have been training people and developing techniques for implementing ORM within their units. The COMACC emphasized that this implementation was a change in philosophy and not necessarily a new safety program. Top leadership touts ORM as a means to further reduce accidents and preserve our scarce resources while enhancing mission effectiveness. In order for units to apply the four principles of ORM, they need to develop and

integrate some ORM programs—this can not just be a philosophy change. ACC units are developing these programs and they are creating problems at the same time. If the problems continue, they could impede the whole ORM implementation process. Starting with the next chapter, this paper will address some of the ORM programs within ACC units. Chapter three will detail the problems inherent with these programs, and finally chapter four will discuss some possible solutions to these problems.

Statement of the Research Question

What problems exist at the unit level in ACC's implementation of ORM and how can they be remedied?

Background and Significance of the Problem

In 1987, the US Army implemented Operational Risk Management (ORM) techniques in an attempt to reduce mishaps. By the early 1990s, the Army reduced serious mishaps by more than 80 percent. In 1996, Air Combat Command (ACC) outlined its ORM implementation strategy in an attempt to reduce all types of mishaps while improving operational effectiveness. While this plan allows for a tailored approach to a wing's unique culture, the implementation has created some problems within ACC units. The commander of ACC emphasized that this implementation is a top down change in philosophy and not necessarily a new safety program. This is important because a cultural change is required to integrate ORM seamlessly into everyday missions. However, units are developing ORM programs that quantify risks and these programs are creating problems because they do not understand the limitations of risk quantification. In addition to this misguided quantification, units are not properly integrating ORM into the mission; thus creating extra work that has little benefit. ACC is taking steps to improve the

ORM process at the unit level by providing better information databases and automated risk assessments during mission scheduling. However, these programs are not in place and because of the emphasis ORM has from the top leadership, ACC units are basically trying to do too much too soon. This could seriously impede the ORM implementation plan due to frustration from a lack of progress with regards to minimizing risks and improving mission benefits. This study recommends several possible solutions to these problems but emphasizes that more study is needed to find the best possible solutions to the ORM problems in ACC.

Definitions and Assumptions

For the purpose of this study, definitions from the Air Force Instruction on ORM will be used. Often times these terms will vary based on authors and context. However, most are fairly consistent throughout readings on risk and risk management. If variations exist, it will be noted in this text. The following definitions apply: **Hazard** is any real or potential condition that can cause mission degradation, injury, illness, or death to personnel, or damage to or loss of equipment or property. **Risk** is the probability and severity of loss from exposure to the hazard. Risk is sometimes misused to represent only the probability of an event occurring. Risk must include both probability and consequence. In quantitative terms, risk is the product of these two elements.[3] **Risk assessment** is the application of quantitative or qualitative measures to determine all the levels of risk associated with a specific hazard and defines the probability, severity, and exposure of a mishap that could result from the hazard.[4]

ASSUMPTIONS: The main assumption made in this study presumes there are real or perceived ORM problems at the unit level in ACC. The purpose of this research was to identify some of the problems with ORM, not the level to which the problems exist.

Notes

[1] Air Force Instruction (AFI) 91-213, *Operational Risk Management (ORM) Program*, 1 September 1997, 2

[2] Air Force Pamphlet (AFP) 91-215, *Operational Risk Management (ORM) Guidelines and Tools*, 1 July 1998, 5-6

[3] Dr. Conrow, Edmund H., *The Use of Ordinal Scales in Defense Systems Engineering*, "1995 Acquisition Research Symposium Proceedings," Defense Systems Management College, June 1995, 2

[4] AFI 91-213, 2

Chapter 2

Implementation Efforts to Enhance Operational Risk Management Philosophies

Army, Navy, and Marine Implementation

The Army took the lead in 1987 with its implementation of ORM. It has continued to be a leader in enhancing ORM philosophies. Each of the other services adopted very similar ORM implementation plans in 1996. The basic implementation concept for all the services was service-wide training from the top down, integration of ORM into mission critical processes, and finally creating a cultural change in the way missions are managed to weigh the risks against the benefits and make informed decisions to improve combat capabilities. The key to this implementation is training from the top down. All the services have completed most of their initial training throughout their respective service and are integrating the training into entry level and command level training programs to perpetuate ORM philosophies.[1] Each of the services emphasize in training that ORM is not a new safety program, rather a philosophy. Basically the services are looking for a way to create a cultural change. This is a sound implementation plan and the Air Force continues with its efforts to implement ORM.

Air Force ORM Implementation

The Air Force implementation plan for ORM is detailed in AFI 91-213 with guidelines and tools described in AFP 91-215. The Air Force plan is a top-down approach. The ORM steering committee is chaired by the Air Force Chief of Safety and is made up of a representative from each major command (MAJCOM) (including the Air National Guard). Higher headquarters commanders are tasked to direct the development of their command's ORM programs and appoint ORM managers.[2] The Air Force ORM training program begins with initial military training for both enlisted and officer and continues at the unit level.[3] Commanders receive ORM training as part of their commander training course and supervisors are the principle advocates for the ORM program to ensure individuals apply ORM on a day-to-day basis.[4] Clearly the Air Force top-down ORM implementation strategy is sound. All of this training and supervisory involvement is taking place in ACC units, so why are there problems with the ORM implementation?

It may not be a problem with the implementation strategy but more in units trying to do too much implementation too soon. Although AFI 91-213 does not set a timeline for implementation, an implied timeline does exist. In general terms the first step is training, the second step is integration, and the third step is the desired cultural change to achieve the ORM goals. The training details ORM expectations, goals, principles, fundamentals of risk management, and tools and techniques to apply what is learned. The ORM process, coupled with the tools and techniques, are the items needed to integrate ORM into operations. Once there is true integration, not separate ORM processes, then the units are well on their way to cultural change. True integration becomes the barrier to cultural change. Training becomes a barrier to integration. The Air Force has made exceptional efforts to enhance ORM training. The Air

Force needs to make exceptional efforts to enhance ORM integration before they can expect units to achieve an ORM cultural change. **One problem this study found is that units are not truly integrating ORM, they are creating additional ORM processes at the wrong point in the mission process.** Units are creating quantitative measures of risks without the proper background information to do so. The units are getting ahead of the implied ORM implementation timeline and that could impede the whole ORM initiative to gain a cultural change. So, what is happening within ACC units that may impede ORM implementation from a perspective of a top-down strategy on training, integration, and cultural change?

ACC ORM at the unit level

This study gathered information from each ACC wing by talking to the safety offices and discussing ORM at the base. Most bases have an individual designated as the focal point for ORM issues within the wing. From this discussion I learned that most wings have an ORM program designed to help the squadrons work through ORM issues and assist in the integration of ORM. Some, but not all, of the wings were using some of the tools and resources outlined in AFP 91-215. The bottom line is ACC units are adhering to the top-down implementation philosophy. Wing supervision is involved with ORM and advocates the use of ORM techniques for day-to-day operations. With this emphasis, base personnel receive ORM training from various sources and attempt to implement what they have learned in their respective missions.

Training: Air Force ORM training is a top-down effort starting with senior leadership and mandates for all Air Force personnel to have received ORM training by 1 October 1998. ACC has done its part in maintaining the perpetual nature of ORM training. ACC wings claim that nearly everyone has received at least the Awareness Training as outlined AFI 91-213. Each wing has taken the extra effort to either send people to advanced ORM training or have ORM

teams come to the base to do on-site training. Eighth Air Force has an excellent on-site training program and team.[5] Individuals attending these weeklong courses are usually mid-level supervisors. New squadron commanders receive basic ORM training during ACC's Squadron Commanders Course.[6] As a whole, ACC is doing very well with perpetuating ORM philosophies through training.

Integration: ORM integration essentially means that the ORM process is internal to mission procedures. ACC units are creating ORM processes hoping they will be accepted as part of the mission procedure. However, they are still separate processes, which generally are not being accepted. The most obvious case in point is the use of risk assessment matrices. Examples are shown in Appendix A.

Several ACC units are developing and using ORM worksheets as an identification and analysis tool. To build the worksheets, units collect information from current guidance, experienced unit personnel, and a variety of other sources. Matrices are a collection of critical elements within the mission and summed-up to assess risk and elevate decisions to an appropriate level to establish accountability. The matrices are completed prior to the mission, so it appears to be a proactive process to mitigate risks. The idea seems to apply all the principles of ORM, but the process is not being accepted as integral to the mission. Often times it is thought of as "just another piece of paper to fill out," or individuals 'work' the numbers so the summarized outcome of the worksheet reflects their own intuitive conclusion.

ACC units are using three different levels of ORM: (1) Time-Critical, (2) Deliberate, and (3) Strategic.[7] The first is mental or intuitive risk management. Deliberate is the application of the 6-step ORM process (shown in Figure 1) that uses experience and brainstorming to identify hazards and develop controls using a series of tools and techniques as detailed in AFP 91-215.

Strategic ORM uses the 6-step process more thoroughly by involving research and analysis from multiple sources such as databases and statistical experience. The difference between the three is the level of analysis, manpower, and time allocated to the ORM process.

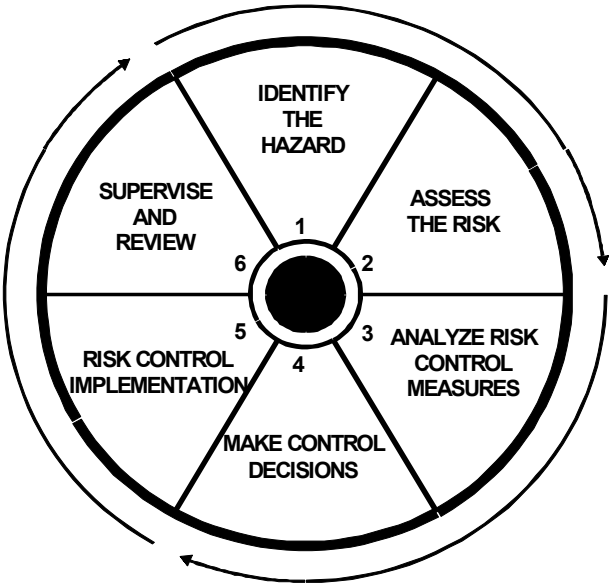

Figure 1. Operational Risk Management 6-step Process

As stated, ACC units are using all three levels of ORM. Time-critical ORM is being applied daily to operations, but then again, ACC units have been doing this intuitive risk analysis for years which has helped to bring their accident rates down to the low values seen today. This study found several examples of deliberate ORM. When the Eight Air Force ORM training team goes to a base, they have the class of about 50 people perform deliberate ORM on an important process on that base. This type of training shows base personnel and supervisors they can set up ORM committees to run through the ORM process and produce useful information for the base. These committees can easily produce detailed risk analysis for specific issues. For example, Barksdale AFB weapons storage was scrutinized using some of the ORM tools and this committee developed a detailed analysis to improve how weapons were stored inside the building. Decisions were made based on this committee's recommendations and changes were

made to the storage procedures. They later learned they had not considered all the risks and they had a few incidents. However, they learned from their mistakes and improved on the analysis.[8] The bottom line is this committee addressed an issue that was considered important and the unit chose to spend man-hours to find reasonable solutions. This is a form of ORM integration; a conscience choice to improve the workplace and allocate resources to make it happen. If this unit had chosen to make each weapons individual fill out a worksheet each time they stored a weapon, they would not have been integrating ORM but adding it to the process of storing weapons. ORM committees are a useful tool in addressing specific issues and integrating deliberate ORM at the right point into the mission process.

Finally, strategic ORM is not being used much within ACC units because the informational databases do not exist or are too difficult to retrieve and analyze data. Cannon AFB performed a strategic ORM process on its Bird/Aircraft Strike Hazard (BASH) program by combining three separate databases into one analysis.[9] However, to do this they had to create their own historical database because the Air Force BASH database was not capable of numerical analysis and data manipulation, only search and retrieve. Cannon AFB was able to integrate strategic BASH ORM into the daily mission process by applying risk controls ahead of the mission scheduling process which eliminated the need for aircrews to perform a strategic BASH analysis on a daily basis. However, aircrews still used intuitive measures to assess risks during daily flight operations, avoided hazardous environments, and channeled BASH information to the supervisor of flying for other aircrews. This is an example of varying levels of ORM being applied at different points in the mission process. ACC units lack the necessary information databases and analysis of those databases to generate effective strategic ORM. With the definition of strategic ORM in AFI 91-213, this is the only level of ORM that can truly be considered quantitative. Both time-

critical and deliberate levels are intuitive and experiential in nature. ACC units are attempting to apply quantitative analysis to issues that are not quantifiable, and that will be discussed in the next chapter.

Cultural Change: Finally, cultural change or acceptance of ORM philosophies in ACC units is not overly high. This study did not assess the level of acceptance, only that ORM is not fully accepted as a mainstream process. Although not statistically proven in this study, people consider ORM a safety program, not a new philosophy. However, progress toward a cultural change is taking place because of the training people have received so far. Because of this training, people in ACC understand that ORM exists and they are attempting to finds ways to apply it in their workplace. An ACC ORM cultural change has a long way to go before it will be considered integral to the mission rather than just another safety program. Continued training will help, but ORM integration is the next key barrier to this cultural change.

Notes

[1] OPNAV Instruction 3500.39, Marine Corps Order 3500.27, *Operational Risk Management*, October 1997. On Line, 10 Feb. 1999, Available at http://www.hqmc.usmc.mil/safety.nsf and navigate to Contents, then ORM, then Policy.

[2] Air Force Instruction (AFI) 91-213, *Operational Risk Management (ORM) Program*, 1 September 1997, 3

[3] Ibid, 4-5

[4] Ibid, 5

[5] Maj Phil Tabor, 8AF/SEF, interviewed by author, November 1998

[6] ACC Squadron Commanders Course, Day 6, Slide 85, On Line. Internet, March 1, 1999. Powerpoint presentation available from http://wwwmil.acc.af.mil/dp/DPP/day6.ppt, This presentation shows that the level of training to the Squadron CC's is based on ORM awareness rather than an in-depth teaching of ORM principles, tools, and techniques.

[7] Air Force Pamphlet (AFP) 91-215, *Operational Risk Management (ORM) Guidelines and Tools*, 1 July 1998, 13

[8] Lt Col Leadford, 2nd Bomb Wing Safety Office, interviewed by author, 4 December 1998.

[9] Maj David Pedersen, This is work the author accomplished while assigned as the 27th Fighter Wing Chief of Flight Safety at Cannon AFB, October 1997 to June 1998.

Chapter 3

ORM Problems in ACC Units

From the discussion in Chapter two, two main problems were identified that will be addressed in this chapter. The first is **a lack of integration of ORM into the mainstream mission process** and second, **the use or misuse of risk quantification**. Integration is the key barrier to cultural change. Additionally, the misuse of risk quantification is indicative of the lack of or misuse of risk information and demonstrates that units are attempting to do too much too soon in the implementation process.

ORM Cultural Change by way of Integration

> *A key objective of ORM is to accomplish the ORM process as an integrated aspect of mainstream mission processes. When ORM is effectively integrated, it quickly ceases to be consciously identifiable as a separate process.*
>
> --Air Force Pamphlet 91-215
> Operational Risk Management (ORM) Guidelines and Tools

Cultural change is a natural byproduct of ORM integration. Process integration will produce cultural change.[1] AFP 91-215 does not go into detail how units should integrate ORM other than to say that ORM should be integrated into the planning process. There are three ORM integration problems discussed in this chapter: 1) the ORM process versus the mission process, 2) resource allocation, and 3) cultural acceptance to perform the tasks required to integrate ORM.

A fourth area of ORM integration is training, but ACC has already taken considerable steps to enhance and perpetuate ORM training so it is not discussed as a problem.

The ORM 6-step process is just that, a process which takes resources, training, and acceptance to perform. That process must be done somewhere in the mission process and yet be integrated into the daily operations of the mission so that it no longer is seen as separate. An additional ORM process must be a conscience choice by the mission supervisor to allocate additional resources such as time, people, and information to perform the ORM function. Hence resource allocation becomes important to ORM integration. Training is required to perform the ORM process. Finally, the concepts of ORM must be culturally accepted within the organization for it to be seriously considered during the mission process. Each of these areas are essential to the integration of ORM into the mainstream mission process. If any one element is degraded, the overall affect on ORM integration is degraded.

Integrating ORM into the Mission Process

Integrating the ORM process into the mission process is not an easy matter. What does it mean to integrate ORM? Where in the mission process do you integrate ORM? For starters, integrating ORM means integrating either deliberate or strategic levels of ORM principles. Time-critical ORM is not something that is normally done on paper; it is purely an intuitive, time-sensitive level of analysis. Time-critical ORM is achieved through ORM training and acceptances of ORM principles so people will perform some form of intuitive ORM in time critical situations. When ORM is integrated, it does not mean the ORM 6-step process has to be conducted at a single point in the mission process. There could be several levels of ORM throughout the mission process. Figure 2 shows a simple view of a typical mission process.

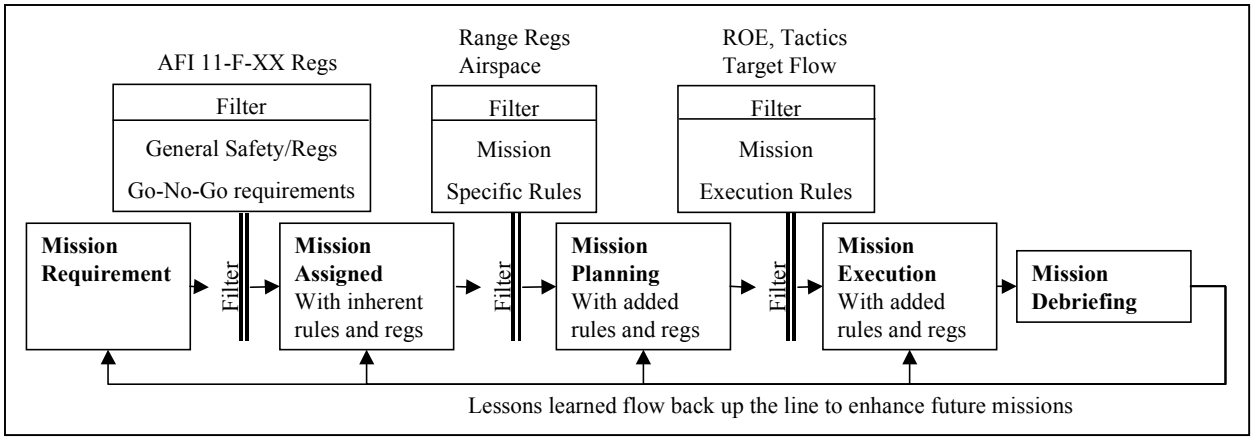

Figure 2. Typical Mission Process

Generally, each phase of the mission process passes through a filter (of sorts) which applies regulations and rules on that and later phases of the mission. When the mission is executed it has all of these inherent rules to keep the mission from failing. Note that this is a simple view and there are several means to go backwards on this mission flow to make changes if required to enhance mission effectiveness. If the mission is debriefed then individuals learn lessons so the mission can be improved the next time it is executed. These individual lessons apply to the mission phases and not necessarily to the filters that impose restrictions on the mission except for possibly at the execution phase. Most of the learning and feedback takes place within the mission planning through mission debrief phases. ACC units do not have a consolidated method for feedback throughout the entire mission process. ORM needs that feedback method to be integrated into the mission. Recall that ORM step 6 (Supervise and Review) is essentially a feedback loop so that ORM can perpetuate and improve as the cycle iterates. Figure 3 shows a general example of how ORM can be integrated into the mission. Different levels of ORM are applied at different points in the process to minimize the rules and replace them with risk controls. (Often times these risk controls will be similar to the rules they replace. The difference is the risk controls are based on risk and benefit analysis rather than rules not based on this

analysis.) In this example, the mission is executed with a list of risk controls imposed on the mission. During the mission debrief these risk controls are evaluated for their impact on mission success. This is where the benefits analysis gains attention. Units are already doing some of these debrief tasks such as incident reports, in-flight emergency (IFE) worksheets, and airspace/range utilization sheets to name a few. The problem is that none of this data is being collected and consolidated for risk/benefit analysis. The feedback loop does not emphasize risk analysis and therefore there is no procedure for the varying levels of ORM to get needed information to do the ORM process ahead of the mission. At some bases, units are placing a risk worksheet at an inappropriate point in the mission process and the foundation (information loop) of the ORM function within the mission does not exist. The input to integrated ORM is risk and benefit lessons learned databases with a means of data analysis. The output of integrated ORM is risk controls at various points along the mission process. ORM procedures in ACC are not populating a risk database or creating feedback necessary to iterate the ORM process within the mission process. Thus, there is a lack of ORM integration within ACC.

ORM Resource Allocation

AFP 91-215 states: "To effectively apply risk management, commanders must dedicate time and resources to incorporate risk management principles into the planning process." ORM resource allocations involve time, information, and people. AFP 91-215 describes three levels of risk management that can be applied to a task: time-critical, deliberate, and strategic.[2] Therefore, the level of ORM determines how much time should be allocated to the ORM function. The more involved the ORM process, the more time, information, and people are required to perform the task.

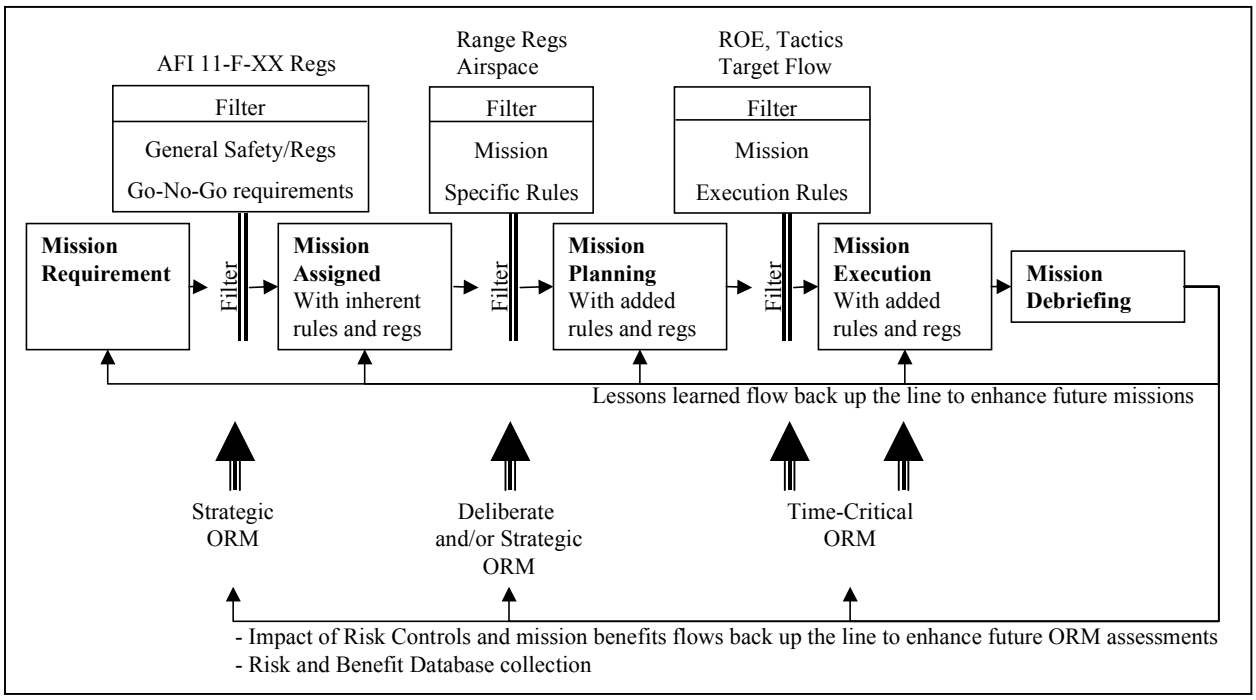

Figure 3. ORM Integrated into Mission Process

Information is critical to the ORM process. There are multiple sources and countless tools and techniques to manage and manipulate information. For strategic or deliberate risk management, broad mission critical risk information is required to perform analytical risk assessments; otherwise the assessment falls back to an intuitive-experiential based assessment by the people performing the analysis. For squadrons to bridge the gap from intuitive to quantitative risk management, they first need integrated information systems. These systems do not yet exist. The Air Force is working with the Army to develop a Risk Management Information System (RMIS).[3] The Air Force has several databases available depending on the mission and the type of information required to perform the ORM analysis. The most obvious is the Air Force Safety Center's accident database. This database can be manipulated to obtain and quantify risk factors such as probability and consequence. The database is difficult to use and the RMIS should replace it with more manageable risk information. There are hundreds of databases maintained at each base for various tasks (i.e. maintenance, parts, crew duties, range

utilization, bomb tracking, etc.). These databases are not designed for quantitative risk analysis—that is, the identification of probability and consequence. Therefore, units lack the necessary informational databases to perform quantitative risk analysis.

Finally, trained people are a required resource to perform the ORM process. ACC ORM training is designed to give a majority of the people a basic understanding of ORM principles and a few people detailed ORM training. ACC squadrons are using people extensively to build and develop ORM information. One common allocation throughout ACC is to use people during ACC directed safety days. These safety days are used to generate functional area hazard lists, which are prioritized and up-channeled to the wing for possible analysis. While these lists have generated valuable information, having the entire wing generate hazard lists every safety day has rapidly lost its charm. The lists are repetitive and often degenerate down to the level of nuisance hazards such as traffic and parking lot issues. Squadrons could make much better use of this resource in developing better ways to integrate ORM rather than just producing repetitive hazard lists. ACC does not have enough people trained to the level of detail required to perform strategic ORM principles. Basically, people are trained at a introductory level and are being asked to analyze information which is not designed to be used for risk analysis and the process is not being integrated which is creating extra ineffective ORM work.

ORM Cultural Acceptance

Cultural acceptance means people at all levels are willing to perform the ORM tasks. In an article for the Army's FlightFax magazine, cultural change to ORM has four key barriers: (1) smaller force with more missions, (2) personalities, (3) competition, and (4) career aspirations.[4] The Air Force barriers can easily fit into these categories as well. The Air Force has certainly been a part of the "do more with less" military draw downs since the beginning of the 1990's.

Changing the minds of mid-level managers from the mindset of "that's the way we've always done it" to incorporating ORM into the process creates a difficult personality barrier to cultural change. Additionally with competition, people do not want to be out done or passed over, therefore, finding a way to make ORM integration competitive could boost cultural acceptance. In an on-going study of how to implement safety programs, Dan Peterson says; "what gets measured and rewarded gets done."[5] Career aspirations also can affect what gets done in the military. People will go to great lengths to accomplish tasks that are perceived as beneficial to their career. One case in point is to acquire a masters degree. Military officers have spent countless hours of their own time getting a degree just to "fill a promotion square." With these four barriers, implementing ORM is no different.

ORM is important and needs to gain cultural acceptance. General Ryan, Air Force Chief of Staff said in his 1998 Air Force Posture Statement that "ORM is key to maintaining readiness in peacetime, dominance in combat, and a crucial component for force protection.".[6] In AFI 91-213, it says that ORM applies to all Air Force personnel and functional areas including the Air Force Reserve and Air National Guard.[7] If ORM is so important then measure it and make it accountable. Getting this type of buy-in is certainly difficult. During an ACC Safety Conference I attended in October 1997, the director of ACC ORM asked if wing ORM programs should be inspected--the answer was a resounding NO! This was at a time when Quality Air Force Assessments (QAFA) were still fresh on everyone's mind. QAFAs were tied to promotions and the inspection (measurement) was how it was tied. If a wing got excellent or outstanding ratings, these were certainly included on individual performance reports, which were used for promotion boards. The problem is finding a way to observe and measure ORM functions so that individuals can be rewarded in a way they perceive is beneficial and not just

required to get a certain score so they can have it recorded for promotions. If people perceive a true benefit, then they will make an effort to perform the ORM tasks that will break down the barriers listed here. ORM cultural acceptance in ACC is low and therefore a problem to ORM integration.

In summary, ACC units have problems with ORM integration. They are not applying appropriate levels of ORM at the right point in the mission process. Units are not collecting, consolidating, and analyzing risk information. There is no feedback loop to emphasize risk analysis and therefore there is no process for the varying levels of ORM to get needed information to do the ORM process ahead of the mission. Units do not have the necessary information required to perform strategic and deliberate ORM or they are attempting to do so with an inadequate or inappropriate risk database. For the most part, ORM resources are not yet available for ACC units to effectively use, yet they are still trying to apply strategic ORM principles with risk worksheets. Additionally, performing the ORM function is not culturally accepted because there is no incentive, other than top-down pressure for compliance, to perform the ORM tasks. The bottom line is that units are trying to apply risk management principles before the necessary risk management infrastructure is established. The worst example of this is the use of worksheets to satisfy a commander's need to show that ORM is being accomplished. The next section details the limitations and problems with risk quantification techniques in ACC.

Quantification of Risk and Risk Matrices

True risk quantification is the product of the probability of occurrence with the consequence of occurrence.[8] The Air Force outlines one form of risk quantification using what it calls a "Risk Assessment Code" (RAC) as shown in Table 1. A RAC is usually codified as a two digit alphanumeric such as "2C." The "2" represents the severity of occurrence and the "C" represents

the probability of occurrence. An identical risk assessment matrix is given as a means to assess risks for a specific task in AFP 91-215, Attachment 3 "Risk Assessment Tools, Details, and Examples." In this AFP 91-215 attachment, it lists three limitations and concerns with the use of the matrix: (1) subjectivity both in terms of interpretation of the matrix categories and the interpretation of the hazard being assessed; (2) inconsistency, assessments will vary based on subjectivity from one rater to another; and (3) lack of a range of rankings.[9] AFP 91-215 goes on to expand the matrix to allow more rankings as shown in Table 2 below. If you took all the numbers in Table 2 and lined them up along a scale from 1 to 20, you would have an ordinal scale of risks because the values would be based on probability and severity. That is not what is happening in ACC squadrons.

Table 1. Risk Assessment Code

			PROBABILITY			
			LIKELY	PROBABLE	POSSIBLE	UNLIKELY
			A	B	C	D
EFFECT	Perm Disability	I	1	1	2	3
	Partial Disability	II	1	2	3	4
	Lost Workday	III	2	3	4	5
	First Aid Req'd	IV	3	4	5	5

Source: AFI 91-301, "Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program" , 1 June 1996

Table 2. Modified Risk Matrix

			PROBABILITY				
			FREQUENT	LIKELY	OCCASIONAL	SELDOM	UNLIKELY
			A	B	C	D	E
EFFECT	CATASTROPHIC	I	1	2	6	8	12
	CRITICAL	II	3	4	7	11	15
	MODERATE	III	5	9	10	14	16
	NEGLIGIBLE	IV	13	17	18	19	20
			Risk Levels				

Source: AFI 91-215, "Operational Risk Management (ORM) Guidelines and Tools", 1 July 1998.

Squadrons are using "risk" scales or "risk" assessment matrices to determine levels of "risks" for various tasks. (The term “risk” is used in this manner to illustrate that the word risk is being used, but they do not include the probability and consequence elements of risk.) During this research I acquired multiple worksheets from various sources, and while not all the worksheets were from ACC units, they all had similar characteristics. The scales are ordinal in nature. That is, they rank various elements from high to low, or, for example, they use a scale from, 1 to 5 to represent rank orderings of the elements. There are several characteristics of ordinal scales that must be considered when using them to make decisions. In the paper "The Use of Ordinal scales in Defense Systems Engineering," Dr. Edmund Conrow makes a very detailed case and lists several caveats for using ordinal scales in risk analysis. First, ordinal scale values represent rank orderings. Typically the values on these scales do not represent probability and consequence to the category they are assigned and therefore are not risk values.[10] Generally speaking, ordinal scales represent uncertainty. Second, ordinal scales are not absolute, nor do they represent cardinal numbers.[11] (A number which represents a value rather than a ranking.) Third, ordinal scales generally have arbitrary intervals between scale levels.[12] For example, a score of 5 is greater than 2 but not 2.5 times greater. Forth, ordinal scales are monotonic and positive.[13] A score of 5 is greater than 4 which is greater than 3, and so on. Finally, while a scale level assigned to an element is correct, the value is not meaningful beyond an ordering sense.[14] Generally speaking, ordinal scales are not calibrated and thus, it is not possible to perform any mathematical operations with any degree of confidence.[15] Dr Conrow goes on to assert:

> Given multiple ordinal scales, the analyst or program manager is often tempted to roll-up the scores mathematically into a single value. I have examined a variety of normalization schemes and averaging techniques--*none of them yield meaningful results*. In general it is recommended that raw ordinal scores be used in the program's risk management…tracking process. *When a single score is needed per category, then the highest of the subcategory scores should be used*.

> Although this represents a conservative approach, it prevents potentially noteworthy issues from being masked and overlooked.[16] (Emphasis added)

The essence of Dr. Conrow's discussion is that risk matrices cannot be summed to give a "risk factor" or "risk gauge" to be used for some other purpose. In ACC, the other purpose is to show that “risks” are being elevated to a higher authority, which satisfies a need to document and show a paper trail for accountability. These worksheets would not stand up to scrutiny if a true accountability issue were in question. Furthermore, if categories of scores are used (Dr. Conrow recommends using ordinal scales in risk management) and some general assessment must be made on the whole of the categories, then use the highest score of all the categories rather than the sum of the scores. Dr. Conrow's analysis makes it very clear that the use of ordinal scales, such as those being used in ACC squadrons, for anything more than the relative comparison of one category to another is meaningless. The matrices that I found being used in squadrons categorize hazardous elements of a task, which would be construed as hazards not risks. The most that can be derived from these matrices is that a score in one category may be relatively higher than another category based on the assessment made by the individual using the matrix. This information could then be used to help make a decision during the mission process. However, rolling-up all the categories into a single score to make a decision is inappropriate.

Some of the matrices are quite in-depth and serve a very useful purpose to categorize hazardous elements of the task. This can be useful in highlighting to a mission manager which elements are critical to the task so effective decisions can be made. Two examples of these matrices are included in Appendix A. The first example "Aircraft Towing Matrix" basically uses ordinal scales to represent "risks" within each category. The manager is asked to circle the appropriate block and proceed to the next category until each is done. Each of the four categories asks generic, yet valuable questions that give a sense of criticality for the section when

it comes to performing the task of towing an aircraft. Finally the manager is asked to add the scores and compare the results to a "risk gauge" at the bottom which assigns a level of responsibility. This example is divided into four categories. As an example, apply the values 4, 2, 3, 4 for categories A through D respectfully. The most that can be said about this matrix is that "Personnel Experience" (category A score = 4) is considered more hazardous to this task than categories B and C, and similar to category D. The summed total gives a score of 13, which equates to a "risk gauge" that is off the charts and requires Maintenance Supervision to be accountable for the task. The scenario that produced these numbers is simple: An inexperienced tow crew working at the end of their shift (9 hours) with good equipment, which they use frequently, are about to tow an aircraft using radios in a noisy, congested area to get the aircraft into a hanger for maintenance because the winds have picked up to 25 knots. In my experience with maintenance, this is not an off-the-scale risky scenario. This is conjecture on my part, but the point is that simple everyday scenarios can produce seemingly high-risk ventures when applied to inappropriately used "risk matrices." Notice on this example that even if all the categories where scored as 1, the risk gauge would almost exceed the Tow Supervisor's level of responsibility, meaning that at this squadron nearly every towing would have to be "signed off" by a higher authority. This is easily fixed as shown in the second example where the low end of the scale is zero. What *should* be said about this first example is the tow supervisor is about to embark on a task with a "risk factor" of 4 (the highest of the four categories). What he does with this factor would depend on squadron policy. Some ideas that come to mind are to mention it to the flight line supervisor (Bear or Ram 5 in this example) and quickly brief the tow crew of the extra hazards associated with the high winds, congested area, use of radios, and an inexperienced crew. The essence of the matrix is still accomplished, that is, task critical questions were asked,

potential hazards identified, and a level of responsibility was assessed—all qualitatively, not quantitatively. If you remove the quantitative elements from this example, the matrix would reduce to a set of questions and possible answers. In other words, an Aircraft Towing Briefing Guide for the tow supervisor. These questions could easily be placed into the flight line work cards and either mentally assessed at the time of the task or briefed to the whole crew depending on the situation. The bottom line is that an inappropriate quantitative time-critical ORM process is replaced with an intuitive time-critical ORM procedure that is easily integrated into the towing mission process.

One more point with this first example. Are the four categories the only critical sets of hazards associated with towing an aircraft? Depending on the situation, I would answer no. This matrix could create the perception that these are the only areas that need to be assessed when in fact there could easily be more critical factors involved. A set of questions or a simple briefing (a memory jogger to the critical elements of the task) may generate more questions and better assessments based on the situation of the task rather than a pre-defined matrix, extra paper work, and supervisory signatures required before a task can even begin. Integration of critical task assessments does not come from extra paper work or signatures.

The next example in Appendix A is similar because it essentially uses ordinal scales, yet different because the worksheet has weighted categories horizontally and vertically in an attempt to calibrate the relative strength of one category to another. Again Dr. Conrow addresses the issue of calibration explicitly:

> Techniques exist that may be used to calibrate ordinal scales, such as the Analytical Hierarchy Process (AHP).[17] (The calibration of scale levels within a single ordinal scale can be viewed as vertical calibration. Calibration (Weighting) between scales can be viewed as horizontal calibration.) While this may provide a relative calibration within a scale for different levels, or between scales, it will not absolutely calibrate any scale level or weighting between scales… the

> calibrated scores are not probabilities, and the absolute magnitude of any scale level generally remains unknown. …The lowest scale level does not represent zero probability or uncertainty in almost any instance. In addition, it is not advisable to perform mathematical operations on scales with relative calibration because the meaning of the results may be difficult to interpret. …it is generally of greater interest to note each score, than the sum, average, or other combination of the scores[18].

First Dr. Conrow defines ordinal scale calibration or weighting and emphasizes that the calibrations are not absolute values, nor are they values of probabilities that can be combined with a consequence element to obtain risk He again noted these numbers should not be summed nor averaged to collect a single representative number from the list of scores. The thing Dr. Conrow warns against is precisely what is taking place in ACC squadrons. In the second example in Appendix A, each category scale is given "points" such as 0, 20, and 30 rather than an ordinal scale of 1, 2, and 3. Furthermore, the relative weight from one category to the next varies. The "Excessive Delay…" category has a scale from 0 to 10, whereas the "Mission Complexity" category has a scale from 0 to 50. This weighting within and between scales gives a perception of calibration. It is important to note, this is only a perception and not statistically sound numerical values. All the matrices that were weighted were derived from experience and intuition and not statistical probabilities that one category carries more weight than another. I would offer a guess to the uncertainty of the weighting to be on the order of ± 25 points, or half the total range of this scale. Again, this is conjecture, but the point is that uncertainty within these matrices is relatively high. If an attempt is made to sum these figures to produce a "Level of Approval Required" (as in this example), than the uncertainty of that number (which also must be summed) is exceedingly high to the point that having a "Level of Approval" scale becomes meaningless. This example is indicative of others that I have seen for aircrew and flight operations.

Switching to the positive aspects of matrices, I have already mentioned a couple points. First, matrices can produce a list of critical elements to tasks and missions. One squadron produced a questionnaire and then consolidated the answers to build a detailed "risk" matrix to be filled out during each mission. This means the matrix was created from a vast collection of the experience within the wing. Second, matrices can show a rank ordering relationship among the categories within the matrix, and, if the matrices are not summed, this rank ordering can show where the uncertainty is within the mission.

Above, I alluded to the fact that ordinal scales could be derived from true risk (incorporating both consequence and probability) by using the values in table 2 as the ordinal scale. If these values are then used, it may be possible to calibrate the matrices using the Analytical Hierarchy Process (AHP) or other calibration methods to provide a helpful relative calibration within a scale for different levels, or between different ordinal scales.[19] (This study does not address how this is done.) The draw back is a very task intensive and information dependent analysis. The need for detailed, accessible databases and database manipulation is required to make this endeavor work. It is task intensive because every hazard for a given task must be analyzed against a probability and consequence matrix as shown in Table 2. The undertaking would be very information dependent because each hazard would need historical data or collaborated intuitive data in order to perform a probability and consequence analysis. All of this data would need to be stored and manipulated using a powerful, accessible database for the analysis. The endeavor to calibrate a true risk matrix is enormous. Yet it has been done. In the article *Some Considerations for Implementing Risk Management in Defense Programs,* Dr. Conrow and Mark Fredrickson wrote:

> Risk assessment summary level charts, detailed matrix charts, and quad charts were successfully used by the SPO [System Program Office] director on several occasions to brief the program to higher-level DoD and Service management.

These matrices and risk assessment summaries were first modified to reduce inconsistencies and improve assessment accuracy. The SPO in this case factored in the limitations of quantitative risk analysis and the limitations of matrices to produce a risk management process that was improved over a 3-year period.[20]

As it stands now in ACC squadrons, the matrices that have been developed are examples of how not to use matrices for operational risk management assessments. They are ordinal scales that generally yield uncertainty rather than risks. The numbers used within each category are not based on statistical analysis but experiential data, which can be misleading and misinterpreted when filled out by various people. The matrices attempt to sum the categories to determine which level of supervision is required for the task. The category descriptions and scale descriptions are often open to interpretation, which leads to more uncertainty. Finally, these worksheets undermine the attempt to integrate ORM into the squadron by creating extra work that is outside the mainstream of the mission process. The only good thing these worksheets have in common is they identify some, but not all, of the critical elements for the mission they represent and a means for inexperienced people to reflect on the thoughts and ideas of the experienced people who put the matrices together.

Notes

[1] Dierberger, Paul A., *The Operational Risk Management Course.* Transportation Safety Institute, OK. February 1997. Course presented to Air Combat Command, Langely AFB, VA, 10-13 Feb 1997, Page 19, Slide 38 This is the original course material presented to ACC initial cadre of ORM champions in early 1997. This material serves as the basis for describing ORM as it is being applied and taught to ACC units.

[2] Air Force Pamphlet (AFP) 91-215, *Operational Risk Management (ORM) Guidelines and Tools*, 1 July 1998, 13

Notes

[3] John D. Phillips, Headquarters Air Force Safety Center, Chief, Operational Risk Management, Kirtland AFB, interviewed by author, 20 November 1998. The Army's Risk Management Information System can be accessed (with permission by justifying information requirement) at http://rmis.army.mil/

[4] Konitzer, Brig Gen Thomas J. *The Challenges of Change.* FlightFax 25 no. 1 (October 1996): pages 2-4. Addresses change in a smaller Army with different mission, increased ops-tempo and leaner budgets by using ORM. Talks about the Army's safety cultural dilemma and asks the question "Can we change our culture?" Also addresses the Army's barriers to cultural change with respect to ORM.

[5] Peterson, Dan, *The Dan Peterson Safety Management Series*, Core Media Training Solutions, 1990, chapter 3

[6] Air Force Posture Statement 1998, On-line, 8 Aug 1998, Available at http://www.af.mil/lib/afissues/1998/posture/page2.html

[7] Air Force Instruction (AFI) 91-213, *Operational Risk Management (ORM) Program*, 1 September 1997, 1

[8] Dr. Conrow, Edmund H., *The Use of Ordinal Scales in Defense Systems Engineering*, "1995 Acquisition Research Symposium Proceedings," Defense Systems Management College, June 1995, 2

[9] AFP 91-215, Attachment 3, 98-99

[10] Conrow, 3

[11] Ibid

[12] Ibid

[13] Ibid

[14] Ibid

[15] Ibid

[16] Ibid, 4

[17] Saaty, Thomas L., "Multicriteria Decision Making: The Analytical Hierarchy Process," RWS Publications, Pittsburgh, 1991 in *The Use Of Ordinal Scales In Defense Systems Engineering,* ed. Dr. Edmund H. Conrow, in "1995 Acquisition Research Symposium Proceedings," Defense Systems Management College, June 1995, page 458

[18] Conrow, 3

[19] Dr. Conrow, Edmund H. *Some Limitations of Quantitative Risk Analysis Approaches Used in Project Management.* 4 April 1998. On Line. Internet, 16 November 1998. Available from http://www.acq.osd.mil/te/programs/se/risk_management/papers_speeches_briefs/lqra.pdf.

[20] Dr. Conrow, Edmund H., Fredrickson, Mark A., *Some Considerations for Implementing Risk Management in Defense Programs.* Program Manager Magazine, January-February 1996. On Line. Internet, 16 November 1998. Available from http://www.dsmc.dsm.mil/pubs/pdf/pmpdf96/conrow.pdf.

Chapter 4

Possible Solutions to the ORM Problems in ACC Units

Chapter three discussed two main ORM problems in ACC units. The first was ORM integration to achieve ORM cultural change. This was further broken down into three subcategories of process integration, resource allocation, and acceptance. The second main problem was the misuse of risk matrices or trying to quantify risks that are not quantifiable. There are no easy solutions to these problems. This chapter briefly discusses some possible solutions (typed in bold) to help in the implementation of ORM. However, the most likely solution to the problems will only come from further study and analysis of ORM at the unit level. ORM is important to the wellbeing of the Air Force and time spent studying it and finding solutions is worth the effort.

Integration of ORM

Chapter three detailed some of the problems with ORM integration in ACC units divided into three subcategories. First, units were not integrating the ORM process at appropriate points in the mission process and there were ineffective feedback methods throughout the mission process to improve risk analysis. The input to integrated ORM is information and its analysis. The output of integrated ORM is risk controls at various points along the mission process. The solution to this problem is first to establish where in the mission process ORM techniques need to be applied and then setup a method to collect, manipulate, and analyze information about the

mission that can be used to perpetuate the ORM process. In finding where ORM needs to be applied to the mission process, AFI 91-213 states:

> Individuals writing doctrine and planning should apply the ORM concepts. The initial development and annual review of plans, directives and other guidance provide the opportune time to ensure the application of ORM principles.[1]

Other than this, AFI 91-213 does not mention anything more about ORM integration. AFP 91-215 discusses ORM integration throughout the pamphlet. **Integration is the key to cultural change; more details need to be taught during advanced ORM training.** These instructions are correct in stating that ORM needs to be done in the planning phase, but they need to expand what level of ORM at which level of planning and a discussion of where the information should come from. Figure 3 (in Chapter three) showed a possible solution for this type of ORM integration. The key in this example was an information loop after the mission that flowed back to the varying levels of ORM throughout the mission process to apply risk controls at appropriate points in the process. For example, strategic ORM is used to determine general Go-No-Go criteria for assigning a specific mission to specific individuals. Once this is done, these risk controls apply throughout the mission process and do not have to be done again during the mission planning phase or mission execution phase. ORM needs to be applied at appropriate points in the mission process. The information feedback must be developed to include risk and benefit information so a comparison can be made. As stated earlier, much of this data is already being collected, just not in a format useful to risk calculations. Units are collecting daily information about each mission that is flown to include hazards, maintenance, range/air space use, and so on. Rather than having aircrews fill out a risk worksheet prior to the flight, which has little impact, have them fill out a post flight analysis sheet to be collected for future risk/benefit assessments.

The second category within the ORM integration problem was resource allocation. The main problem here was getting information worthy of risk analysis. For the most part, risk information that is available to be manipulated and analyzed does not exist in ACC units. ACC Safety and the Air Force Safety offices are making excellent efforts to get risk information down to the squadrons. For example, ACC is already testing a program called Squadron Assistant/Risk Assessment (SARA). This is an excellent decision aid for aircrew scheduling and aircrew management with risk management built-in.[2] Basically the database program provides automatic risk calculations on crewmembers and mission. It validates crew currency, and allows inputs for a commander to adjust how the assessment performs.[3] SARA automates the general Go-No-Go criteria during the mission scheduling process and allows for electronic input for tracking information (i.e., electronic bubble sheets). This is a good thing. However, SARA has inherent flaws. For starters, it generates a single risk number that is derived from ordinal scales and this number is used to trigger a "risk flag" used to inform the commander of a potential problem. Also, it allows commanders to manipulate the assessment, which could add confusion to the risk numbers unless used properly; this will require extensive training. As discussed in Chapter 3, the use of ordinal scales presents a wide range of problems if they are not used properly. SARA has the potential to mislead commanders by presenting a single risk number while masking other factors due to a summing algorithm that does not trigger a risk flag or risk flags that are set so low they trigger false signals. **These inherent flaws in SARA need to be addressed prior to the distribution of the program.**

Another effort to provide risk information is with the joint Risk Management Information System (RMIS). RMIS is an Army product being developed to provide a central information collection point of risk information for major weapons systems.[4] The Air Force Safety Center is

involved in its development because it plans to incorporate a similar product for the Air Force.[5] The current information is primarily accident and/or incident related but could be expanded in the future. RMIS information is easily accessible with search and retrieve functions unlike the current Air Force accident information database. This is an excellent product that will be value added to current ORM processes once it is fielded.

RMIS and SARA are good for the advancement of risk information to each ACC unit. The problem is this information infrastructure is not available yet. ACC units are getting ahead of the information infrastructure implementation. During the initial ORM training at Langley AFB, part of the integration emphasized that: "ORM generates momentum as value adds are understood. Avoid getting out in front of this understanding."[6] **The solution to this problem is to wait for the information infrastructure before attempting to perform strategic ORM**. This infrastructure will not come on-line all at once. Units need to assess what information is available and determine when a strategic ORM process can effectively be done. Generally speaking, ACC units are not making this assessment of the available information before attempting strategic ORM. When the information becomes available, then ACC units can implement strategic ORM functions. In the meantime, intuitive/experiential (deliberate and time-critical) ORM is the only real option, which means ACC units need to wait to perform risk quantification techniques.

The last category within the ORM integration problem was cultural acceptance to perform the ORM tasks. There are several barriers to getting people to perform and there are no easy solutions to these barriers. I will offer a few here, but more study needs to be done in this area to find better solutions. The main barrier is getting people to do the work. In *The Dan Peterson Safety Management Series* he states: "If there is one problem with traditional safety programs

that towers over all others, it is ignoring middle management in the program."[7] Middle management responsibilities can be quantified, observed, and measured. Rewards can be structured for the desired behavior and a system devised to link the reward to the behavior consistently.[8] The key to this middle manager involvement is a reward system. Again, Peterson's research concluded that: "Two factors determine how much effort a person puts into a job: (1) his or her opinion of the value of the rewards and (2) the connection the person sees between effort and those rewards."[9] Rewards can range from personal satisfaction of a job well done down to a small totem of recognition such as an award. The rewards program determines the relationship of the reward value and the effort involved in the task. For example, a small reward begets a small effort. There is not an ORM rewards structure in ACC. To get an effective reward system, there needs to be an objective reward criterion, which includes some form of measurement. **ORM integration needs some form of reward system so people will be willing to perform ORM tasks. To get a reward system, ORM objectives needs to be quantified, observed and measured**. As stated in the previous chapter, observing and measuring ORM objectives through a formal inspection system will probably fail for reasons similar to why QAFA's were canceled in the Air Force. However, setting objectives at the wing level and having wing leadership devise a measurement system that is truly directed towards rewards rather than compliance is a likely candidate. The ACC Squadron Commander's Course makes an attempt to get new commanders to induce ORM change.[10] The course lists three inducement examples: (1) show people how good it can be, (2) you cannot expend unlimited resources on issues cloaked in ORM, and (3) commit intelligent application of ORM procedures.[11] The first of these could be part of a rewards system in that people recognize benefits of ORM in tangible combat capability. The second inducement is the commitment to

ORM is zero-sum gain in resources; there are limited resources and care must be taken to apply these resources to appropriate functions. The third inducement suggests the use of proper or intelligent ORM techniques. In order to develop these inducements, ACC units need more detailed ORM training on how to integrate ORM, and an information infrastructure so the ORM analysis can be performed.

Quantitative versus Qualitative Risk Assessments

The bottom line solution to quantitative risk management is do not do it until the information is available at the unit level. In the meantime, **ACC units should concentrate their efforts on deliberate and time-critical ORM techniques using experiential and intuitive analysis**. These analyses could include ordinal scales as long as the unit is aware of the limitations and they do not attempt to sum or average the scales to obtain overall risk levels or set levels of responsibility. The easiest way to do this is to **take the existing risk matrices and remove all the numbers from the page but leave the columns**. During the assessment, if one or more elements in the matrix are in the far right column, then the person doing the assessment uses good judgement to make changes or advises his or her supervisor. **Finally, use these matrices as a means to improve the existing briefing guides or use briefing guides as a replacement for the matrices**. Briefing guides can provide as much information as the matrices without the perception that the matrix is a complete analysis of the mission risks. Briefing guides were developed from experience and intuitive analysis. Current briefing guides are linear in nature. This means they are a single column of elements, which are briefed in sequential order. Matrices can be used to create a two dimensional briefing guide that include elements of severity for each briefing item. This new form of briefing guide would create a guide and decision aid all in one. This is ORM at its best in today's ACC. When the elements of the

briefing guide can be quantified with a historical database that is when ACC can move to strategic levels of ORM integration.

Notes

[1] Air Force Instruction (AFI) 91-213, *Operational Risk Management (ORM) Program*, 1 September 1997, 3

[2] Col Ronald Garhart, Headquarters Air Combat Command, interviewed by author, Dec 98

[3] Capt Randy Cole ACC/DOR, interviewed by author, December 1998, briefing presented to USAF/XO on SARA in November 98

[4] Risk Management Information System, on line, internet, available at http://rmis.army.mil/

[5] John D. Phillips, Headquarters Air Force Safety Center, Chief, Operational Risk Management, Kirtland AFB, interviewed by author, December 98.

[6] Dierberger, Paul A., *The Operational Risk Management Course.* Transportation Safety Institute, OK. February 1997. Course presented to Air Combat Command, Langely AFB, VA, 10-13 Feb 1997, Page 23, Slide 46 This is the original course material presented to ACC initial cadre of ORM champions in early 1997. This material serves as the basis for describing ORM as it is being applied and taught to ACC units.

[7] Peterson, Dan, *The Dan Peterson Safety Management Series*, Core Media Training Solutions, 1990, 56

[8] Ibid, 56

[9] Ibid, 60

[10] ACC Squadron Commanders Course, Day 6, Slide 88, On Line. Internet, March 1, 1999. Powerpoint presentation available from http://wwwmil.acc.af.mil/dp/DPP/day6.ppt

[11] Ibid, slide 89

Chapter 5

Conclusions

There are two main problems that exist at the unit level in ACC's implementation of ORM. The first is a general lack of integration of ORM into the mainstream process. The second is the misuse of risk quantification. The essence of these problems is that ACC units are attempting to implement ORM but they are getting ahead of the implementation plan. The plan calls for basic ORM training for all Air Force personnel, integration of ORM into mission critical processes while developing a cultural change to accept ORM principles as a way of doing day-to-day operations. ACC units are not integrating the ORM process at appropriate points in the mission process. The information needed to integrate ORM is not available to ACC units in a form that can be used for strategic risk analysis. Most units are performing time-critical or deliberate levels of ORM and this implies the use of intuitive analysis. However, ACC units are attempting to quantify this analysis which is creating more problems. They are getting ahead of the implementation of risk information and required decision aids to help them integrate ORM into critical mission processes. There is a general misuse of risk quantification because people do not understand how to quantify risks nor do they know the limitations of risk quantification. Again, units are getting ahead of the implementation because they don't understand risk quantification. Finally, there are several barriers to the cultural acceptance for people to perform the ORM functions. People do not see enough value in the rewards of doing ORM, which means the effort

they put toward ORM is limited. ACC units are going to great lengths to implement ORM, but the problems being created could impede the overall implementation of ORM because people will lose interest in the program due to frustration.

The remedies to these problems are detailed in the previous chapter. The main solutions are for ACC units to be patient during this implementation process. The necessary information to perform strategic ORM functions is not generally available. The Air Force is taking steps to bring these types of assets to the operational unit, but they do not yet exist. The ORM cultural change that is desired will not occur until ORM is better integrated into mission processes and the tangible value of ORM is realized by the average airman. This cultural change is achieved through good training and effective integration of ORM. Finally, ACC units should eliminate the use of risk matrices until they understand risk matrix limitations and have the information to develop them. Patience is the key to ORM implementation.

Appendix A

Examples of Risk Assessment Matrices

AIRCRAFT TOWING MATRIX

Risk Assessment

To determine the amount of risk involved, circle the number corresponding to the known hazards listed on the charts. Then total all the numbers and take the average of the categories to get a final idea of how risky the task will be. Check the risk gauge at the end to determine how much risk is involved. Take action to eliminate or reduce risks wherever possible.

A: Are the personnel experienced? How long have the personnel been at work?

Personnel Experience	Hours at work		
	0-8 hours	8-12 hours	12+hours
Inexperienced	3	4	5
Experienced	2	3	4
Highly Experienced	1	2	3

B: What type of condition is the required equipment in? How often is the required equipment utilized?

Equipment Condition	Equipment utilized		
	High	Medium	Low
Poor	3	4	5
Good	2	3	4
Excellent	1	2	3

C: Are there communication devices available to the team? How noisy is the area?

Personnel Experience	Hours at work		
	0-8 hours	8-12 hours	12+hours
Inexperienced	3	4	5
Experienced	2	3	4
Highly Experienced	1	2	3

D: What are the weather conditions like? What type of shelter is available for task?

Weather Devices	Noise		
	Low	Medium	High
None	3	4	5
Whistles	2	3	4
Radios	1	2	3

RISK GAUGE

POINTS	1-5	6-10	11-12
Level of responsibility	Tow Super	Bear/Ram 5	Flight/Mx Super
	Low Caution	Medium Caution	High Caution

Example 2 - RISK ASSESSMENT MATRIX

Experience	CDTS Sorties; all Greater than 500 hours	0	CDTS Sorties (Anyone<500 hours) IQC Sorties (Instructors >1000 hrs or students > 35 hrs)	20	IQC Sorties (Instructors less than 1000 hours or students less than 35 hours)	30
Proficiency-Flts in last 60 days; CDTS=3	8 or more	0	4-7	10	Less than 4	20
Crew Rest	Well rested	0	1 crewmember tired	25	2 or more crewmembers tired	25 ea.
Show Time	0700-1900	0	0545-0659 or 1900-2100	15	2100-0544	30
Delayed Launch	0-2 hrs	0	2-4 hrs	10	More than 4 hrs	40
Sortie Length	Up to 5 hrs	0	5-7 hrs	10	More than 7 hrs	25
Excessive Delay—Flying beyond required activities	Less than 1 hours	0	1-2 hours	5	More than 2 hrs	10
Recovery Time from previous night flight	>12 hrs land time—start of msn planning day activities	0	>9 buy < 12 hrs land time-start of msn planning day activities	10	< 9 hrs from land time to start of mission planning day activities	25
Weather	VMC	0	Marginal VFR	15	IMC	30
Illumination	Daylight	0	Civil Twilight ¾ full moon, non NVG	15	Less than ¾ moon non NVG	30
Scheduled Crew Duty Day	Day <12 hrs Night < 9 hrs	0	Day 12-15 hrs Night 9-12 hrs	10	Day > 15 hrs Night > 12 hrs	25
Familiar with Environment	Very Familiar	0	Somewhat familiar	25	Never seen before	50
Formation Size	Single ship	0	2-ship	10	3-ship or more	25
Mission Planning	No interrupts or scheduled activity	0	Some interrupts; one scheduled activity	10	Numerous interrupts; more than one scheduled activity	35
Transition	Night ¾ hr Day 1 hr total	0	Night ¾-11/2 hrs total Day 1-2 hrs total	10	Night more than 1 ½ hrs total Day more than 2 hrs total	20

Mission Complexity	All simulated bomb runs	0	Live/Shape drop or FIE	20/ 15/ 25	Flag Exercise; Strike package with FIE	50
Total						
Grand Total						

Overall Risk & Level of Approval Required

Points	**Risk**	**Signature Required**	**Signature**
<50	Very Low		
50-95	Low		
100-145	Medium		
150-195	Caution	SQ CC/DO	
200-245	High	OG/CC	
250 or more	Danger	WG/CC or Higher	

Bibliography

Air Force Instruction (AFI) 91-213, *Operational Risk Management (ORM) Program*, 1 September 1997.

Air Force Pamphlet (AFP) 91-215, *Operational Risk Management (ORM) Guidelines and Tools*, 1 July 1998.

Air Force Posture Statement 1998, On-line. Internet, 8 Aug 1998, Available at http://www.af.mil/lib/afissues/1998/posture/page2.html

"Bird/Aircraft Strike Hazard (BASH) Airfield Risk Assessment". Air Combat Command. Flight Safety, Langley AFB, VA. On Line. Internet, 16 November 1998. Available from Http://wwwmil.acc.af.mil/se/afldorm.html.

Dierberger, Paul A., *The Operational Risk Management Course.* Transportation Safety Institute, OK. February 1997. Course presented to Air Combat Command, Langely AFB, VA, 10-13 Feb 1997.

Dr. Conrow, Edmund H. *Some Limitations of Quantitative Risk Analysis Approaches Used in Project Management.* 4 April 1998. On Line. Internet, 16 November 1998. Available from http://www.acq.osd.mil/te/programs/se/risk_management/papers_speeches_briefs/lqra.pdf.

_____., *The Use of Ordinal Scales in Defense Systems Engineering*, "1995 Acquisition Research Symposium Proceedings," Defense Systems Management College, June 1995.

_____., Fredrickson, Mark A., *Some Considerations for Implementing Risk Management in Defense Programs.* Program Manager Magazine, January-February 1996. On Line. Internet, 16 November 1998. Available from http://www.dsmc.dsm.mil/pubs/pdf/pmpdf96/conrow.pdf.

Joint Publication 3-0, *Doctrine for Joint Operations,* 1 February 1995.

Konitzer, Brig Gen Thomas J. "The Challenges of Change." *FlightFax* 25 no. 1 (October 1996).

OPNAV Instruction 3500.39, Marine Corps Order 3500.27, *Operational Risk Management*, October 1997. On Line, 10 Feb. 1999, Available at http://www.hqmc.usmc.mil/safety.nsf and navigate to Contents, then ORM, then Policy.

Petersen, Dan. *The Challenge of Change -- Creating a New Safety Culture.* Safety Training Systems, Creative Media Development Inc., Portland OR. 1995

_____. *The Dan Peterson Safety Management Series*, Core Media Training Solutions, 1990.

Risk Management Information System (RMIS), On line. Internet, available at http://rmis.army.mil/.

"Risk Management of Bird Hazards on Low-Level Routes and Ranges", Air Combat Command. Flight Safety, Langley AFB, VA. On Line. Internet, 16 November 1998. Available from http://wwwmil.acc.af.mil/se.

Saaty, Thomas L., "Multicriteria Decision Making: The Analytical Hierarchy Process," RWS Publications, Pittsburgh, 1991 in *The Use Of Ordinal Scales In Defense Systems*

Engineering, ed. Dr. Edmund H. Conrow, in "1995 Acquisition Research Symposium Proceedings," Defense Systems Management College, June 1995.

"Squadron Commanders Course", Air Combat Command, On Line. Internet, March 1, 1999, available at http://wwwmil.acc.af.mil/dp/1DPP/day6.ppt.